

CLAIMS

1. A multi-frequency antenna duplexer comprising:
a package, and
a plurality of antenna duplexers, mounted in said package, having
5 different passing bands from each other,

wherein each of said plurality of antenna duplexers includes a
transmitter surface acoustic wave (SAW) filter and a receiver SAW filter
having a passing band different from the passing band of the transmitter SAW
filter.

10

2. The multi-frequency antenna duplexer of claim 1,
wherein the transmitter SAW filter of said each of the plurality of
antenna duplexers is formed on a first piezoelectric substrate,
the receiver SAW filter of said each of the plurality of antenna
15 duplexers is formed on a second piezoelectric substrate, and
in each of the receiver SAW filters, a phase shift substrate for rotating
a phase of a transmission band of said multi-frequency antenna duplexer
including said each of the receiver SAW filters is incorporated in the package.

20

3. The multi-frequency antenna duplexer of claim 1,
wherein said each of the transmitter SAW filters and the receiver SAW
filters of said multi-frequency antenna duplexer are formed on one
piezoelectric substrate, and

in said each of the receiver SAW filters, a phase shift substrate for
25 rotating a phase of a transmission band of the antenna duplexer including
said each of the receiver SAW filters is incorporated in the package.

4. The multi-frequency antenna duplexer of claim 1,
wherein a phase shift substrate is formed in an inner layer of the
package.

5 5. A multi-frequency antenna duplexer comprising:
a package, and
a plurality of antenna duplexers, mounted in said package, having
passing different bands from each other,
wherein each of said plurality of antenna duplexers includes a
10 transmitter filter and a receiver filter having a passing band different from a
passing band of the transmitter filter,
at least one of the transmitter filter and the receiver filter is a bulk
wave filter, and
when one of the transmitter filter and the receiver filter is the bulk
15 wave filter, another is a surface acoustic wave (SAW) filter.

6. The multi-frequency antenna duplexer of claim 5,
wherein the receiver filter of any one of the plurality of antenna
duplexers is the SAW filter, in the SAW filter, a phase shift substrate for
20 rotating a phase of a transmission band of the antenna duplexer including the
SAW filter is incorporated in the package.

7. The multi-frequency antenna duplexer of claim 6,
wherein the phase shift substrate is formed in an inner layer of the
25 package.

8. A multi-frequency antenna duplexer comprising:

a package,

two antenna duplexers, mounted in said package, having different passing bands each other, and

a branching filter for coupling antenna terminals of the two antenna duplexers and one antenna terminal included in the package,

wherein each of said two antenna duplexers includes a transmitter surface acoustic wave (SAW) filter and a receiver SAW filter having a passing band different from a passing band of the transmitter SAW filter.

10 9. The multi-frequency antenna duplexer of claim 8,

wherein each of the transmitter SAW filters of the two antenna duplexers is formed on a first piezoelectric substrate,

the receiver SAW filter of each of the two antenna duplexers is formed on a second piezoelectric substrate, and

15 in said each of the receiver SAW filters, a phase shift substrate for rotating a phase of a transmission band of the multi-frequency antenna duplexer including the receiver SAW filter is incorporated in the package.

10 10. The multi-frequency antenna duplexer of claim 8,

20 wherein the transmitter SAW filter and the receiver SAW filter of said each of the two antenna duplexers are formed on one piezoelectric substrate, and

in the receiver SAW filter, a phase shift substrate for rotating the phase of transmission band of the antenna duplexer including the receiver
25 SAW filter is incorporated in the package.

11. The multi-frequency antenna duplexer of claim 8,

wherein the phase shift substrate and branching filter are formed in an inner layer of the package.

12. An multi-frequency antenna duplexer comprising:
- 5 a package,
- two antenna duplexers, mounted in said package, having different passing bands each other, and
- a branching filter for coupling antenna terminals of the two antenna duplexers and one antenna terminal included in the package,
- 10 wherein each of said two antenna duplexers includes a transmitter filter and a receiver filter having a passing band different from a passing band of the transmitter filter,
- at least one of the transmitter filter and the receiver filter is a bulk wave filter, and
- 15 when one of the transmitter filter and the receiver filter is the bulk wave filter, another is a surface acoustic wave (SAW) filter.

13. The multi-frequency antenna duplexer of claim 12,
- wherein the receiver filter is the SAW filter, in the SAW filter, a phase
- 20 shift substrate for rotating a phase of transmission band of the antenna duplexer including the SAW filter is incorporated in the package.

14. The multi-frequency antenna duplexer of claim 13,
- wherein the phase shift substrate and branching filter are formed in
- 25 an inner layer of the package.